

35.C10698 CI/DII

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:)
SHOICHI YAMAZAKI, ET AL.) : Examiner: R. Mack
Appln. No.: 09/511,243) : Group Art Unit: 2873
Filed: February 23, 2000) :
For: HEAD-UP DISPLAY DEVICE) March 16, 2001
WITH CURVED OPTICAL :
SURFACE HAVING TOTAL :
REFLECTION (AS AMENDED) :

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Assistant Commissioner for Patents
Washington, DC 20231

REQUEST FOR INTERFERENCE

Sir:

The Official Action dated January 23, 2001, having been withdrawn, as indicated in the Interview Summary Record dated March 5, 2001, and the Communication dated March 6, 2001, favorable consideration of the subject application is earnestly solicited. (While Applicants assume that no extension of time fees under 37 C.F.R. § 1.17 remain due, any such fees required may be charged to Deposit Account 06-1205.)

Claims 11 through 47 are pending, with Claims 11, 17, and 23 being independent.

Applicants wish to thank the Examiner for the courtesies extended in granting and conducting personal interviews on January 19, 2001, and March 13, 2001. At the

interviews, Applicants' representative and the Examiner discussed the proposed interference, and Applicant understands that the Examiner is in tentative agreement with the instant Request for Interference. Favorable consideration is earnestly solicited.

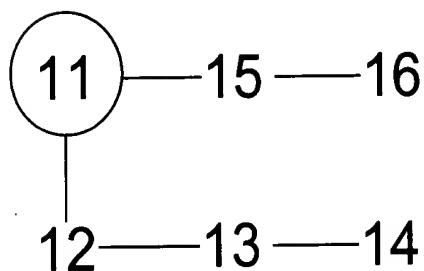
Pursuant to 37 CFR 1.607, Applicants respectfully request that an interference be declared involving all claims, i.e., Claims 11 through 47, of the present application of Shoichi Yamazaki, et al. ("Yamazaki") and at least Claims 1, 3 through 12, 14, 15, and 17 through 24 of U.S. Patent No. 5,875,056 ("Takahashi '056") to Koichi Takahashi ("Takahashi").

A. Introduction

As noted in the Preliminary Amendment filed February 23, 2000, the Yamazaki claims have been copied either exactly or in modified form from Takahashi Claims 1, 3 through 12, 14, 15, and 17 through 24. For ease of discussion, the relationship between the Yamazaki claims and the Takahashi claims has been set forth by Applicants in the following Claim Chart (which shows the independent claims and singly dependent claims) and Table A (which shows multiple dependent claims):

CLAIM CHART

Yamazaki claims



Takahashi claims

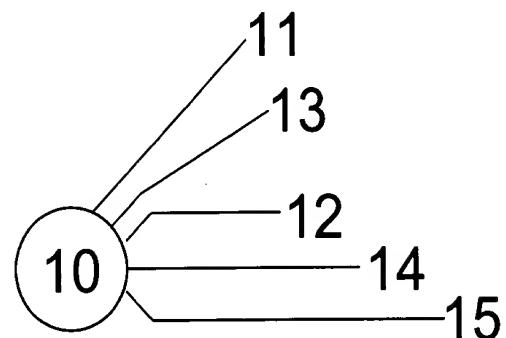
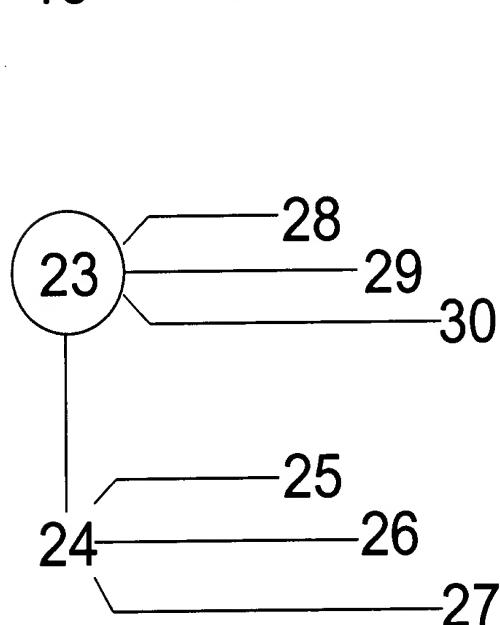
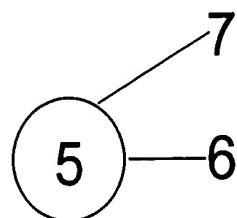
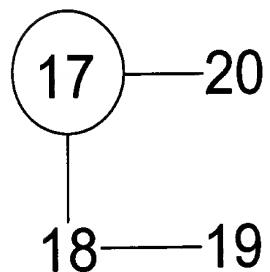
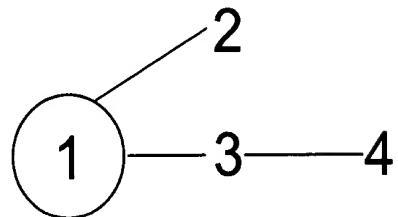


TABLE A

Yamazaki claim	dependent upon	Takahashi claim	dependent upon
21 (with 22 dependent therefrom)	17-20	8 (with 9 dependent therefrom)	5-7
31	23-30	17	10-12, 14, 15
32	17-20, 23-30	18	5-7, 10-12, 14, 15
33	17-20, 23-30	19	5-7, 10-12, 14, 15
(a) 34 & (b) 35	(a) 17, 20, 23, 28-30, & (b) 18, 19, 24-27	20	5-7, 10-12, 14, 15
36	17-20, 23-30	21	5-7, 10-12, 14, 15
---	---	22	1, 5, 10
---	---	23 (with 24 dependent therefrom)	1, 5, 10

It will be appreciated that Yamazaki Claims 37 through 47 variously depend from Yamazaki Claims 11 through 35 and further recite that the medium is acrylic resin or glass; accordingly, Yamazaki Claims 37 through 47 relate to the same Takahashi claims to which Yamazaki Claims 11 through 35 relate.

B. The counts

Applicants respectfully propose that the interference be declared with two counts. The proposed counts are set forth as follows:

COUNT 1

(A) An optical apparatus comprising:
means for forming an image to be observed; and
an ocular optical system for leading said image to
an observer's eyeball,
said ocular optical system including, in order from
said image side, a third surface which forms an entrance
surface, a first surface which forms both a reflecting
surface and an exit surface, and a second surface which forms
a reflecting surface, said first to third surfaces being
integrally formed with a medium disposed therebetween,
wherein said means for forming an image is an image
display device for forming an image for observation,
said device being disposed at a position facing
said third surface,
wherein at least said first surface in said ocular
optical system is formed from a rotationally asymmetric
curved surface so as to correct aberrations produced by a
decentered surface having an optical action;

OR

(B) An optical apparatus comprising:
a device for displaying an image; and
an ocular optical system for projecting an image
formed by said device and for leading the image to an
observer's eyeball,

 said ocular optical system comprising at least
first, second and third surfaces, in which a space defined by
said surfaces is filled with a medium,

 said device being disposed at a position facing
said third surface,

 said at least first, second and third surfaces
including, in order from the observer's eyeball side toward
said device, said first surface which serves as both a
refracting surface and an internally reflecting surface, said
second surface which serves as a reflecting surface of
positive power and which faces said first surface and is
decentered or tilted with respect to an observer's visual
axis, and said third surface which serves as a refracting
surface closest to said device,

 wherein at least said first surface in said ocular
optical system is formed from a rotationally asymmetric
curved surface so as to correct aberrations produced by a
decentered surface having an optical action;

OR

(C) An optical apparatus comprising:
a device for displaying an image; and
an ocular optical system for projecting an image
formed by said device and for leading the image to an
observer's eyeball,

 said ocular optical system comprising at least
first, second and third surfaces, in which a space defined by
said surfaces is filled with a medium,

 said device being disposed at a position facing
said third surface,

 said at least first, second and third surfaces
including, in order from the observer's eyeball side toward
said device, said first surface which serves as both a
refracting surface and an internally reflecting surface, said
second surface which serves as a reflecting surface of
positive power and which faces said first surface and is
decentered or tilted with respect to an observer's visual
axis, and said third surface which serves as a refracting
surface closest to said device,

 wherein at least said first surface in said ocular
optical system is formed from a rotationally asymmetric
curved surface so as to correct aberrations produced by a
decentered surface having an optical action,

 wherein any one of said first, second and third
surfaces is a decentered aspherical surface;

OR

(D) An optical apparatus comprising:
a device for displaying an image; and
an ocular optical system for projecting an image
formed by said device and for leading the image to an
observer's eyeball,

 said ocular optical system comprising at least
first, second and third surfaces, in which a space defined by
said surfaces is filled with a medium,

 said device being disposed at a position facing
said third surface,

 said at least first, second and third surfaces
including, in order from the observer's eyeball side toward
said device, said first surface which serves as both a
refracting surface and an internally reflecting surface, said
second surface which serves as a reflecting surface of
positive power and which faces said first surface and is
decentered or tilted with respect to an observer's visual
axis, and said third surface which serves as a refracting
surface closest to said device,

 wherein at least said first surface in said ocular
optical system is formed from a rotationally asymmetric
curved surface so as to correct aberrations produced by a
decentered surface having an optical action,

 wherein any one of said first, second and third
surfaces is a decentered aspherical surface, and

 wherein any one of said first, second and third
surfaces is an anamorphic surface;

OR

(E) An optical apparatus comprising:
an image display device; and
an ocular optical system for projecting an image
formed by said image display device and for leading the image
to an observer's eyeball,

 said ocular optical system including a decentered
 optical element comprising at least first, second, and third
 surfaces, in which a space defined by said surfaces is filled
 with a medium, said surfaces including, from said observer's
 eyeball side toward said image display device, said first
 surface serving as both a refracting surface and a totally
 reflecting surface, said second surface serving as a
 reflecting surface of positive power which faces said first
 surface and is decentered or tilted with respect to an
 observer's visual axis, and said third surface serving as a
 refracting surface closest to said image display device,

 said image display device being disposed at a
 position facing said third surface,

 said ocular optical system further including at
 least one optical surface having refracting action, said
 decentered optical element and said at least one optical
 surface being disposed in an optical path which extends from
 said image display device to said observer's eyeball,

 wherein at least said first surface in said ocular
 optical system is formed from a rotationally asymmetric

curved surface so as to correct aberrations produced by a
decentered surface having an optical action.

COUNT 2

An optical apparatus comprising:
means for forming an image to be observed; and
an ocular optical system for leading said image to
an observer's eyeball,

 said ocular optical system including, in order from
 said image side, a third surface which forms an entrance
 surface, a first surface which forms both a reflecting
 surface and an exit surface, and a second surface which forms
 a reflecting surface, said first to third surfaces being
 integrally formed with a medium disposed therebetween,

 wherein said means for forming an image is an image
 display device for forming an image for observation,

 said device being disposed at a position facing
 said third surface,

 wherein at least said first surface in said ocular
 optical system is formed from a rotationally asymmetric
 curved surface so as to correct aberrations produced by a
 decentered surface having an optical action,

 said apparatus further comprising:
 a see-through optical system disposed in the
 vicinity of the second surface of said ocular optical system
 to transmit a bundle of light rays from an outside world and
 lead it to the second surface of said ocular optical system,

 wherein a surface of said see-through optical
 system on which outside world light is incident has a
 configuration approximated to the first surface of said

*Not in
Count 1*

ocular optical system, and a surface of said see-through optical system from which outside world light emanates has a configuration approximated to the second surface of said ocular optical system.

It will be appreciated that the two counts have been formulated upon the basis of various Yamazaki claims, as shown by the following Table B:

TABLE B

Count	Yamazaki claim upon which count is based
1	11, modified to omit the means for fitting the image display device and the ocular optical system to the observer's head (Alternative A); 17 (Alternative B); 17/21 (Alternative C); 17/21/22 (Alternative D); and 23 (Alternative E)
2	16, modified to omit (a) the means for fitting the image display device and ocular optical system to the observer's head, and (b) the shutter

C. Correspondence of claims to counts

1. Summary

Applicants respectfully submit that the claims correspond to the counts as shown in the following Table C:

TABLE C

Count	Claims corresponding to count
1	Yamazaki Claims 11-13, 15, 17-20, 21/(17-20), 22/21/(17-20), 23-30, 31/(23-30), 32/(17-20), 32/(23-30), 33/(17-20), 33/(23-30), 34/17, 34/20, 34/(23 and 28-30), 35/18, 35/19, 35/(24-27), 36/(17-20), 36/(23-30), 37/(11-13 and 15), 38/(17-20), 39/21/(17-20), 40/22/21/(17-20), 41/(23-30), 42/31/(23-30), 43/32/(17-20), 43/32/(23-30), 44/33/(17-20), 44/33/(23-30), 45/34/17, 45/34/20, 45/34/(23 and 28-30), 46/35/18, 46/35/19, 46/35/(24-27), 47/36/(17-20), and 47/36/(23-30), and Takahashi Claims 1, 3, 5-7, 8/(5-7), 9/8/(5-7), 10-12, 14, 15, 17/(10-12, 14, and 15), 18/(5-7), 18/(10-12, 14, and 15), 19/(5-7), 19/(10-12, 14, and 15), 20/(5-7), 20/(10-12, 14, and 15), 21/(5-7), 21/(10-12, 14, and 15), 22/1, 22/5, 22/10, 23/1, 23/5, 23/10, 24/23/1, 24/23/5, and 24/23/10
2	Yamazaki Claims 14, 16, 37/14, and 37/16, and Takahashi Claim 4

2. Detailed explanation of claim correspondence

a. Count 1

Applicants respectfully submit that Yamazaki Claims 11-13, 15, 17-20, 21/(17-20), 22/21/(17-20), 23-30, 31/(23-30), 32/(17-20), 32/(23-30), 33/(17-20), 33/(23-30), 34/17, 34/20, 34/(23 and 28-30), 35/18, 35/19, 35/(24-27), 36/(17-20), 36/(23-30), 37/(11-13 and 15), 38/(17-20), 39/21/(17-20), 40/22/21/(17-20), 41/(23-30), 42/31/(23-30), 43/32/(17-20), 43/32/(23-30), 44/33/(17-20), 44/33/(23-30), 45/34/17, 45/34/20, 45/34/(23 and 28-30), 46/35/18, 46/35/19, 46/35/(24-27), 47/36/(17-20), and 47/36/(23-30), and Takahashi Claims 1, 3, 5-7, 8/(5-7), 9/8/(5-7), 10-12, 14, 15, 17/(10-12, 14, and 15), 18/(5-7), 18/(10-12, 14, and 15), 19/(5-7), 19/(10-12, 14, and 15), 20/(5-7), 20/(10-12, 14, and 15), 21/(5-7), 21/(10-12, 14, and 15), 22/1, 22/5, 22/10, 23/1, 23/5, 23/10, 24/23/1, 24/23/5, and 24/23/10 correspond to Count 1 as follows:

(1) Yamazaki Claim 11

Yamazaki Claim 11 differs from Count 1, Alternative A ("Count 1(A)") in that Yamazaki Claim 11 recites means for fitting the image display device and the ocular optical system to the observer's head (hereinafter referred to as "fitting means"). However, Applicants respectfully submit that fitting means were known in the art as shown by U.S. Patent No. 5,436,765 (Togino '765) (e.g., Fig. 22(a)).

Accordingly, Applicants submit that Yamazaki Claim 11 would have been obvious over Count 1 in view of Togino '765.

(2) Yamazaki Claim 15

Yamazaki Claim 15 depends from Yamazaki Claim 11 and differs from Count 1(A) in that Yamazaki Claim 15 requires the fitting means discussed above with respect to Yamazaki Claim 11, as well as:

(a) a see-through optical system disposed in the vicinity of the second surface of the ocular optical system to transmit a bundle of light rays from an outside world and lead it to the second surface of the ocular optical system; and

(b) a shutter provided at a side of the see-through optical system which is closer to the outside world, the shutter allowing light to be selectively transmitted or shut off.

However, Applicants submit that fitting means were known in the art as shown by Togino '765, as discussed above, and that see-through optical systems and shutters were also known in the art as shown by U.S. Patent No. 5,546,227 (Yasugaki, et al.) (e.g., Fig. 45). For this reason, Applicants submit that Yamazaki Claim 15 would have been obvious over Count 1 in view of Togino '765 and Yasugaki, et al.

(3) Yamazaki Claims 12 and 13 and
Takahashi Claims 1 and 3

Applicants submit that (a) Yamazaki Claim 12 and Takahashi Claim 1 and (b) Yamazaki Claim 13 and Takahashi Claim 3 differ from Count 1(A) in the aspects discussed above with respect to Yamazaki Claims 11 and 15, respectively, (e.g., by reciting, inter alia, fitting means) and further in that they require providing the combination of the image display device and ocular optical system for each of the observer's left and right eyeballs so as to lead an image to each of the eyeballs, with Takahashi Claims 1 and 3 further requiring that the refractive index of the medium is greater than one.

However, Applicants submit that providing an image display device and ocular system for each eye was known in the art as shown by U.S. Patent No. 5,436,765 (Togino '765) (e.g., Fig. 22(a)). Applicants also respectfully submit that the recitation that the refractive index of the medium is greater than one is not a patentable distinction over the recitation in the count that the first through third surfaces are integrally formed with the medium disposed therebetween. Accordingly, Applicants submit that Yamazaki Claim 12 and Takahashi Claim 1 would have been obvious over Count 1 in view of Togino '765, while Yamazaki Claim 13 and Takahashi Claim 3 would have been obvious over Count 1 in view of Yasugaki, et al. and Togino '765.

(4) Yamazaki Claims 37/(11, 12, 13, and 15)

Yamazaki Claims 37/(11, 12, 13, and 15) differ from Count 1(A) in the aspects discussed above with respect to Yamazaki Claims 11, 12, 13, and 15 from which they depend, and further in that the claims recite acrylic resin or glass as the medium. However, Applicants respectfully submit that the use of plastic and glass materials was known in the art. See, e.g., U.S. Patent No. 4,775,217 (Ellis), which shows, e.g., use of glass or plastics at col. 3, lines 66-67, and European Patent Document 0 583 116 (Ingleton), which shows, e.g., use of plastic at col. 2, line 40. For this reason and those advanced above with respect to Yamazaki Claims 11, 12, 13, and 15, Applicants submit that Yamazaki Claims 37/(11, 12, 13, and 15) would have been obvious over Count 1 in view of the art.

(5) Takahashi Claims 22/1, 23/1, and 24/23/1

Takahashi Claims 22/1 and 23/1 depend from Takahashi Claim 1 and differ from Count 1(A) in that Takahashi Claims 22/1 and 23/1 require fitting means and providing the combination for each eye, with the medium having a refractive index greater than one, as discussed above with respect to Takahashi Claim 1, and further require:

(a) a nose support for supporting the optical apparatus, the nose support being provided between the ocular optical systems for the left and right eyeballs so that the

systems are disposed in front of the left and right eyeballs (Takahashi Claim 22/1); or

(b) a cover that covers an observer's ear hole (Takahashi Claim 23/1),

with Takahashi Claim 24/23/1 further reciting that the cover has a speaker.

However, Applicants respectfully submit that it was known in the art to provide fitting means and a combination for each eye, as discussed above with reference to Togino '765, and that the recitation that the refractive index is greater than one is not a patentable distinction over the recitation in the count that the first through third surfaces are integrally formed with the medium disposed therebetween, as discussed above. Applicants also submit that it was known in the art to provide (a) nose supports, as shown by U.S. Patent No. 5,539,422 (Heacock, et al.) (e.g., Figs. 28 through 30 (showing a nose bridge)), and (b) headphones for going over the ear of the observer, as shown by Japanese Laid-Open Patent Application No. 62-214782 ("JP '782") (e.g., Fig. 1, headphone 6 in an apparatus having a viewfinder 4 for observing an image from a camera 3). Accordingly, Applicants submit that Takahashi Claim 22/1 would have been obvious over Count 1 in view of Togino '765 and Heacock, et al., while Takahashi Claims 23/1 and 24/23/1 would have been obvious over Count 1 in view of Togino '765 and JP '782.

(6) Yamazaki Claim 17

Yamazaki Claim 17 is identical to Count 1, Alternative B ("Count 1(B)").

(7) Yamazaki Claim 20

Yamazaki Claim 20 differs from Count 1(B) in that Yamazaki Claim 20 requires that internal reflection from the first surface is total reflection.

However, Applicants submit that it was known in the art to effect internal reflection by using a totally reflecting surface, as shown by Ingleton (e.g., col. 3, lines 1-3; surface 21). Accordingly, Applicants submit that Yamazaki Claim 20 would have been obvious over Count 1 in view of Ingleton.

(8) Yamazaki Claims 18 and 19 and
Takahashi Claims 5 and 6

Applicants submit that (a) Yamazaki Claim 18 and Takahashi Claim 5 and (b) Yamazaki Claim 19 and Takahashi Claim 6 differ from Count 1(B) in the aspects discussed above with respect to Yamazaki Claims 17 and 20, respectively, and further in that they require providing the combination of the image display device and ocular optical system for each of the observer's left and right eyeballs so as to lead an image to each of the eyeballs, with Takahashi Claims 5 and 6 further requiring that the refractive index of the medium is greater than one.

However, Applicants submit that providing a combination for each eye was known in the art as shown by Togino '765, while the refractive index recitation also does not constitute a patentable distinction, all as discussed above. Accordingly, Applicants submit that Yamazaki Claim 18 and Takahashi Claim 5 would have been obvious over Count 1 in view of Togino '765, while Yamazaki Claim 19 and Takahashi Claim 6 would have been obvious over Count 1 in view of Ingleton and Togino '765.

(9) Takahashi Claim 7

Takahashi Claim 7 differs from Count 1(B) in that Takahashi Claim 7 further requires (a) providing the combination of the image display device and ocular optical system for each of the observer's left and right eyeballs so as to lead an image to each of the eyeballs, (b) that the refractive index of the medium is greater than one, and (c) that the first surface has an internally-reflecting region which has been mirror-coated.

However, Applicants submit that providing a combination for each eye was known in the art, as shown by Togino '765, while the refractive index recitation also does not constitute a patentable distinction, all as discussed above. Applicants further submit that effecting reflection by the use of mirrors was also known in the art, as shown by U.S. Patent No. 5,594,588 (Togino '588) or Japanese Laid-Open Patent Application No. 5-303056 ("JP '056"). Accordingly,

Applicants submit that Takahashi Claim 7 would have been obvious over Count 1 in view of Togino and either Togino '588 or JP '056.

(10) Yamazaki Claims 32/(17-20), 33/(17-20), 34/17, 34/20, 35/18, 35/19, and 36/(17-20) and Takahashi Claims 18/(5-7), 19/(5-7), 20/(5-7), 21/(5-7)

These claims differ from Count 1(B) in the aspects discussed above with respect to Yamazaki Claims 17 through 20 and Takahashi Claims 5 through 7 from which they variously depend, and further in that they require:

(a) means for positioning both the device for displaying an image and the ocular optical system with respect to an observer's head (Yamazaki Claims 32/(17-20) and Takahashi Claims 18/(5-7));

(b) means for supporting both the device for displaying an image and the ocular optical system with respect to an observer's head so that the optical apparatus can be fitted to the observer's head (Yamazaki Claims 33/(17-20) and Takahashi Claims 19/(5-7));

(c) means for supporting a pair of the optical apparatuses, or the combinations, at a predetermined spacing (Yamazaki Claims 34/17, 34/20, 35/18, and 35/19 and Takahashi Claims 20/(5-7)); or

(d) that the ocular optical system is used as an imaging optical system (Yamazaki Claims 36/(17-20) and Takahashi Claims 21/(5-7)).

With respect to (a) through (c), Applicants submit that such positioning and supporting means were known in the art, as shown by Togino '765, discussed above. Applicants submit that one having ordinary skill in the art would have been motivated to mount the optical apparatus of Count 1(B) on an observer's head using the positioning or supporting structure of Togino '765 to provide a head mounted display. For this reason and the reasons advanced above with respect to Yamazaki Claims 17 through 20 and Takahashi Claims 5 through 7, Applicants submit that Yamazaki Claims 32/(17-20), 33/(17-20), 34/17, 34/20, 35/18, and 35/19, and Takahashi Claims 18/(5-7), 19/(5-7), and 20/(5-7) would have been obvious over Count 1 in view of the art discussed above with respect to the claims from which they depend and further in view of Togino '765.

As for feature (d), Applicants submit that given that it was known in the art to use ocular optical systems as imaging optical systems, as shown by European Patent Document 0 408 344 (Staveley) (e.g., Fig. 6, items 15 and 37; Fig. 10, items 50 and 72)), one having ordinary skill in the art would have been motivated to so use the ocular optical system of the count. For this reason, and the reasons advanced above with respect to Yamazaki Claims 17 through 20 and Takahashi Claims 5 through 7, Applicants submit that Yamazaki Claims 36/(17-20) and Takahashi Claims 21/(5-7) would have been obvious over Count 1 in view of the art discussed above with

respect to the claims from which they depend and further in view of Staveley.

(11) Yamazaki Claims 38/(17-20),
43/32/(17-20), 44/33/(17-20),
45/34/17, 45/34/20, 46/35/18,
46/35/19, and 47/36/(17-20)

These claims differ from Count 1(B) in the aspects discussed above with respect to Yamazaki Claims 17 through 20, 32/(17-20), 33/(17-20), 34/17, 34/20, 35/18, 35/19, and 36/(17-20) from which they depend, and further in that they recite acrylic resin or glass as the medium. However, Applicants respectfully submit that the use of plastic and glass materials was known in the art, as discussed above with reference to Ellis and ingleton. For this reason and those advanced above with respect to the claims from which they depend, Applicants submit that the claims in question would have been obvious over Count 1 in view of the art.

(12) Takahashi Claims 22/5,
23/5, and 24/23/5

Takahashi Claims 22/5 and 23/5 depend from Takahashi Claim 5 and differ from Count 1(B) in that Takahashi Claims 22/5 and 23/5 require providing the combination for each eye, with a refractive index greater than one, and further require:

(a) a nose support for supporting the optical apparatus, the nose support being provided between the ocular optical systems for the left and right eyeballs so that the

systems are disposed in front of the left and right eyeballs (Takahashi Claim 22/5); or

(b) a cover that covers an observer's ear hole (Takahashi Claim 23/5),

with Takahashi Claim 24/23/5 further reciting that the cover has a speaker.

However, Applicants submit that providing a combination for each eye was known in the art, as shown by Togino '765, while the refractive index recitation also does not constitute a patentable distinction, all as discussed above. Applicants further submit that nose supports and headphones for going over the ears were known in the art as shown by Heacock, et al. and JP '782, respectively, both discussed above. Accordingly, Applicants submit that Takahashi Claim 22/5 would have been obvious over Count 1 in view of Togino '765 and Heacock, et al., while Takahashi Claims 23/5 and 24/23/5 would have been obvious over Count 1 in view of Togino '765 and JP '782.

(13) Yamazaki Claim 21/17

Yamazaki Claim 21/17 is identical to Count 1, Alternative C ("Count 1(C)").

(14) Yamazaki Claim 21/20

Yamazaki Claim 21/20 differs from Count 1(C) in that Yamazaki Claim 21/20 requires that the internal reflection from the first surface is total reflection.

However, Applicants submit that it was known in the art to effect internal reflection by using a totally reflecting surface, as shown by Ingleton, discussed above. Accordingly, Applicants submit that Yamazaki Claim 21/20 would have been obvious over Count 1 in view of Ingleton.

(15) Yamazaki Claims 21/18 and 21/19 and
Takahashi Claims 8/5 and 8/6

Applicants submit that (a) Yamazaki Claim 21/18 and Takahashi Claim 8/5 and (b) Yamazaki Claim 21/19 and Takahashi Claim 8/6 differ from Count 1(C) in the aspects discussed above with respect to Yamazaki Claims 21/17 and 21/20, respectively, and further in that they require providing the combination of the image display device and ocular optical system for each of the observer's left and right eyeballs so as to lead an image to each of the eyeballs, with Takahashi Claims 8/5 and 8/6 further requiring that the refractive index of the medium is greater than one.

However, Applicants submit that providing a combination for each eye was known in the art as shown by Togino '765, while the refractive index recitation also does not constitute a patentable distinction, all as discussed above. For this reason, and for the reasons advanced above with respect to Yamazaki Claims 21/17 and 21/20, Applicants submit that Yamazaki Claim 21/18 and Takahashi Claim 8/5 would have been obvious over Count 1 in view of Togino '765, while Yamazaki Claim 21/19 and Takahashi Claim 8/6 would have

been obvious over Count 1 in view of ingleton and Togino '765.

(16) Yamazaki Claims 39/21/(17-20)

Yamazaki Claims 39/21/(17-20) differ from Count 1(C) in the aspects discussed above with respect to Yamazaki Claims 21/(17-20) from which they depend, and further in that they recite acrylic resin or glass as the medium. However, Applicants respectfully submit that the use of plastic and glass materials was known in the art, as discussed above with reference to Ellis and ingleton. For this reason and those advanced above with respect to the claims from which they depend, Applicants submit that the claims in question would have been obvious over Count 1 in view of the art.

(17) Takahashi Claim 8/7

Takahashi Claim 8/7 differs from Count 1(C) in that Takahashi Claim 8/7 further requires (a) providing the combination of the image display device and ocular optical system for each of the observer's left and right eyeballs so as to lead an image to each of the eyeballs, (b) that the refractive index of the medium is greater than one, and (c) that the first surface has an internally-reflecting region which has been mirror-coated.

However, Applicants submit that providing a combination for each eye was known in the art, as shown by Togino '765, while the refractive index recitation also does

not constitute a patentable distinction, all as discussed above. Applicants further submit that effecting reflection by the use of mirrors was also known in the art, as shown by Togino '588 or JP '056, as discussed above. Accordingly, Applicants submit that Takahashi Claim 8/7 would have been obvious over Count 1 in view of Togino '765 and either Togino '588 or JP '056.

(18) Yamazaki Claim 22/21/17

Yamazaki Claim 22/21/17 is identical to Count 1, Alternative D ("Count 1(D)").

(19) Yamazaki Claim 22/21/20

Yamazaki Claim 22/21/20 differs from Count 1(D) in that Yamazaki Claim 22/21/20 requires that the internal reflection from the first surface is total reflection.

However, Applicants submit that it was known in the art to effect internal reflection by using a totally reflecting surface, as shown by Ingleton, discussed above. Accordingly, Applicants submit that Yamazaki Claim 22/21/20 would have been obvious over Count 1 in view of Ingleton.

(20) Yamazaki Claims 22/21/18 and 22/21/19 and Takahashi Claims 9/8/5 and 9/8/6

Applicants submit that (a) Yamazaki Claim 22/21/18 and Takahashi Claim 9/8/5 and (b) Yamazaki Claim 22/21/19 and Takahashi Claim 9/8/6 differ from Count 1(D) in the aspects

discussed above with respect to Yamazaki Claims 22/21/17 and 22/21/20, respectively, and further in that they require providing the combination of the image display device and ocular optical system for each of the observer's left and right eyeballs so as to lead an image to each of the eyeballs, with Takahashi Claims 9/8/5 and 9/8/6 further requiring that the refractive index of the medium is greater than one.

However, Applicants submit that providing a combination for each eye was known in the art as shown by Togino '765, while the refractive index recitation also does not constitute a patentable distinction, all as discussed above. For this reason, and for the reasons advanced above with respect to Yamazaki Claims 22/21/17 and 22/21/20, Applicants submit that Yamazaki Claim 22/21/18 and Takahashi Claim 9/8/5 would have been obvious over Count 1 in view of Togino '765, while Yamazaki Claim 22/21/19 and Takahashi Claim 9/8/6 would have been obvious over Count 1 in view of Ingleton and Togino '765.

(21) Yamazaki Claims 40/22/21/(17-20)

Yamazaki Claims 40/22/21/(17-20) differ from Count 1(D) in the aspects discussed above with respect to Yamazaki Claims 22/21/(17-20) from which they depend, and further in that they recite acrylic resin or glass as the medium. However, Applicants respectfully submit that the use of plastic and glass materials was known in the art, as

discussed above with reference to Ellis and ingleton. For this reason and those advanced above with respect to the claims from which they depend, Applicants submit that the claims in question would have been obvious over Count 1 in view of the art.

(22) Takahashi Claim 9/8/7

Takahashi Claim 8/7 differs from Count 1(D) in that Takahashi Claim 9/8/7 further requires (a) providing the combination of the image display device and ocular optical system for each of the observer's left and right eyeballs so as to lead an image to each of the eyeballs, (b) that the refractive index of the medium is greater than one, and (c) that the first surface has an internally-reflecting region which has been mirror-coated.

However, Applicants submit that providing a combination for each eye was known in the art, as shown by Togino '765, while the refractive index recitation also does not constitute a patentable distinction, all as discussed above. Applicants further submit that effecting reflection by the use of mirrors was also known in the art, as shown by Togino '588 or JP '056, discussed above. Accordingly, Applicants submit that Takahashi Claim 9/8/7 would have been obvious over Count 1 in view of Togino '765 and either Togino '588 or JP '056.

(23) Yamazaki Claim 23

Yamazaki Claim 23 is identical to Count 1, Alternative E ("Count 1(E)").

(24) Yamazaki Claim 28 through 30

Yamazaki Claims 28 through 30 differ from Count 1(E) in that they recite:

- (a) that the at least one optical surface is disposed between the observer's eyeball and the first surface of the decentered optical element (Yamazaki Claim 28);
- (b) that the at least one optical surface is disposed between the third surface of the decentered optical element and the image display device (Yamazaki Claim 29); or
- (c) that the at least one optical surface is decentered with respect to the observer's visual axis (Yamazaki Claim 30).

However, Applicants submit that these features were known in the art as shown by Ingleton. With respect to features (a) and (c), Applicants submit that Ingleton shows, e.g., in Fig. 9, an optical surface (i.e., the surface of the prism-like member disposed between design eye position E1 and surface 58 which faces face 58 and which is inclined). With respect to feature (b), Applicants submit that Ingleton shows, e.g., in Fig. 7, a lens arrangement 65 disposed between output face 67 of the source 67 and the eyepiece 50. Accordingly, Applicants submit that Yamazaki Claims 28

through 30 would have been obvious over Count 1 in view of ingleton.

(25) Yamazaki Claims 24 through 27 and Takahashi Claims 10, 12, 14, and 15

Applicants submit that (a) Yamazaki Claim 24 and Takahashi Claim 10, (b) Yamazaki Claim 25 and Takahashi Claim 12, (c) Yamazaki Claim 26 and Takahashi Claim 14, and (d) Yamazaki Claim 27 and Takahashi Claim 15 differ from Count 1(E) in the aspects discussed above with respect to Yamazaki Claims 23, 28, 29, and 30, respectively, and further in that they require providing the combination of the image display device and ocular optical system for each of the observer's left and right eyeballs so as to lead an image to each of the eyeballs, with Takahashi Claims 10, 12, 14, and 15 further requiring that the refractive index of the medium is greater than one.

However, Applicants submit that providing a combination for each eye was known in the art as shown by Togino '765, while the refractive index recitation also does not constitute a patentable distinction, all as discussed above. Accordingly, Applicants submit that Yamazaki Claim 24 and Takahashi Claim 10 would have been obvious over Count 1 in view of Togino '765, while Yamazaki Claims 25 through 27 and Takahashi Claims 12, 14, and 15 would have been obvious over Count 1 in view of ingleton and Togino '765.

(26) Takahashi Claim 11

Takahashi Claim 11 differs from Count 1(E) in that Takahashi Claim 11 further requires (a) providing the combination of the image display device and ocular optical system for each of the observer's left and right eyeballs so as to lead an image to each of the eyeballs, (b) that the refractive index of the medium is greater than one, and (c) that the at least one optical surface is formed from a surface which produces chromatic aberration which is approximately equal in quantity but opposite in sign to chromatic aberration prepared by the first surface.

However, Applicants submit that providing a combination for each eye was known in the art as shown by Togino '765, while the refractive index recitation also does not constitute a patentable distinction, all as discussed above. Applicants further submit that it was known in the art to use a lens together with an optical element to form a chromatic doublet minimizing chromatic aberrations, as shown by Heacock, et al. (e.g., Fig. 19; col. 12, line 58 through col. 13, line 5). Accordingly, Applicants submit that Takahashi Claim 11 would have been obvious over Count 1 in view of the aforementioned documents.

(27) Yamazaki Claims 31/(23-30), 32/(23-30), 33/(23-30), 34/(23 and 28-30), 35/(24-27), and 36/(23-30), and
Takahashi Claims 17/(10-12, 14, and 15), 18/(10-12, 14, and 15), 19/(10-12, 14, and 15), 20/(10-12, 14, and 15), and 21/(10-12, 14, and 15)

These claims differ from Count 1(E) in the aspects discussed above with respect to Yamazaki Claims 23 through 30 and Takahashi Claims 10 through 12, 14, and 15 from which they variously depend, and further in that they require:

(a) that the at least one optical surface and the decentered optical element form an air lens (Yamazaki Claims 31/(23-30) and Takahashi Claims 17/(10-12, 14, and 15));

(b) means for positioning both the device for displaying an image and the ocular optical system with respect to an observer's head (Yamazaki Claims 32/(23-30) and Takahashi Claims 18/(10-12, 14, and 15));

(c) means for supporting both the device for displaying an image and the ocular optical system with respect to an observer's head so that the optical apparatus can be fitted to the observer's head (Yamazaki Claims 33/(23-30) and Takahashi Claims 19/(10-12, 14, and 15));

(d) means for supporting a pair of the optical apparatuses, or the combinations, at a predetermined spacing (Yamazaki Claims 34/(23 and 28-30) and 35/(24-27) and Takahashi Claims 20/(10-12, 14, and 15)); or

(e) that the ocular optical system is used as an imaging optical system (Yamazaki Claims 36/(23-30) and Takahashi Claims 21/(10-12, 14, and 15)).

With respect to (a), Applicants submit that it was known in the art to form an air lens with an optical element, as shown by Staveley (e.g., Fig. 9). For this reason and the reasons advanced above with respect to Yamazaki Claims 23 through 30 and Takahashi Claims 10 through 12, 14, and 15, Applicants submit that Yamazaki Claims 31/(23-30) and Takahashi Claims 17/(10-12, 14, and 15) would have been obvious over Count 1 in view of the art discussed above with respect to the claims from which they depend and further in view of Staveley.

With respect to (b) through (d), Applicants submit that such positioning and supporting means were known in the art, as shown by Togino '765, discussed above. Applicants submit that one having ordinary skill in the art would have been motivated to mount the optical apparatus of Count 1(E) on an observer's head using the positioning or supporting structure of Togino '765 to provide a head mounted display. For this reason and the reasons advanced above with respect to Yamazaki Claims 23 through 30 and Takahashi Claims 10 through 12, 14, and 15, Applicants submit that Yamazaki Claims 32/(23-30), 33/(23-30), 34/(23 and 28-30), and 35/(24-27), and Takahashi Claims 18/(10-12, 14, and 15), 19/(10-12, 14, and 15), and 20/(10-12, 14, and 15) would have been obvious over Count 1 in view of the art discussed above with respect to the claims from which they depend and further in view of Togino '765.

As for feature (e), Applicants submit that given that it was known in the art to use ocular optical systems as imaging optical systems, as shown by Staveley, discussed above, one having ordinary skill in the art would have been motivated to so use the ocular optical system. For this reason, and the reasons advanced above with respect to Yamazaki Claims 23 through 30 and Takahashi Claims 10 through 12, 14, and 15, Applicants submit that Yamazaki Claims 36/(23-30) and Takahashi Claims 21/(10-12, 14, and 15) would have been obvious over Count 1 in view of the art discussed above with respect to the claims from which they depend and further in view of Staveley.

(28) Yamazaki Claims 41/(23-30),
42/31/(23-30), 43/32/(23-30),
44/33/(23-30), 45/34/(23 and 28-30),
46/35/(24-27), and 47/36/(23-30)

These claims differ from Count 1(E) in the aspects discussed above with respect to Yamazaki Claims 31/(23-30), 32/(23-30), 33/(23-30), 34/(23 and 28-30), 35/(24-27), and 36/(23-30) from which they depend, and further in that they recite acrylic resin or glass as the medium. However, Applicants respectfully submit that the use of plastic and glass materials was known in the art, as discussed above with reference to Ellis and Ingleton. For this reason and those advanced above with respect to the claims from which they depend, Applicants submit that the claims in question would have been obvious over Count 1 in view of the art.

(29) Takahashi Claims 22/10, 23/10, and 24/23/10

Takahashi Claims 22/10 and 23/10 depend from Takahashi Claim 10 and differ from Count 1(E) in that Takahashi Claims 22/10 and 23/10 require providing the combination for each eye, with a refractive index greater than one, and further require:

(a) a nose support for supporting the optical apparatus, the nose support being provided between the ocular optical systems for the left and right eyeballs so that the systems are disposed in front of the left and right eyeballs (Takahashi Claim 22/10); or

(b) a cover that covers an observer's ear hole (Takahashi Claim 23/10),

with Takahashi Claim 24/23/10 further reciting that the cover has a speaker.

However, Applicants submit that providing a combination for each eye was known in the art, as shown by Togino '765, while the refractive index recitation also does not constitute a patentable distinction, all as discussed above. Applicants further submit that nose supports and headphones for going over the ears were known in the art as shown by Heacock, et al. and JP '782, respectively, both discussed above. Accordingly, Applicants submit that Takahashi Claim 22/10 would have been obvious over Count 1 in view of Togino '765 and Heacock, et al., while Takahashi

Claims 23/10 and 24/23/10 would have been obvious over Count 1 in view of Togino '765 and JP '782.

f. Count 2

Applicants respectfully submit that Yamazaki Claims 14, 16, 37/14, and 37/16, and Takahashi Claim 4 correspond to Count 2 as follows:

(1) Yamazaki Claim 16

Yamazaki Claim 16 differs from Count 2 in that Yamazaki Claim 16 requires fitting means, and a shutter provided at a side of the see-through optical system which is closer to the outside world, the shutter allowing light to be selectively transmitted or shut off.

However, Applicants respectfully submit that fitting means and shutters were known in the art as discussed above with respect to Togino '765 and Yasugaki, et al., respectively. Accordingly, Applicants respectfully submit that Yamazaki Claim 16 would have been obvious over Count 2 in view of Togino '765 and Yasugaki, et al..

(2) Yamazaki Claim 14
and Takahashi Claim 4

Yamazaki Claim 14 and Takahashi Claim 4 differ from Count 2 in the aspect discussed above with respect to Yamazaki Claim 16, and further in that Yamazaki Claim 14 and

Takahashi Claim 4 require providing the combination of the image display device and ocular optical system for each of the observer's left and right eyeballs so as to lead an image to each of the eyeballs, with Takahashi Claim 4 further requiring that the refractive index of the medium is greater than one.

However, Applicants submit that providing a combination for each eye was known in the art as shown by Togino '765, while the refractive index recitation also does not constitute a patentable distinction, all as discussed above. Accordingly, Applicants submit that Yamazaki Claim 14 and Takahashi Claim 4 would have been obvious over Count 2 in view of Yasugaki, et al. and Togino '765.

(3) Yamazaki Claims 37/14 and 37/16

Yamazaki Claims 37/14 and 37/16 differ from Count 2 in the aspects discussed above with respect to Yamazaki Claims 14 and 16 from which they depend, and further in that Yamazaki Claims 37/14 and 37/16 recite acrylic resin or glass as the medium. However, Applicants respectfully submit that the use of plastic and glass materials was known in the art, as discussed above with reference to Ellis and Ingleton. For this reason and those advanced above with respect to Yamazaki Claims 14 and 16, Applicants submit that Yamazaki Claims 37/14 and 37/16 would have been obvious over Count 2 in view of the art.

D. Support for Yamazaki Claims

The following establishes that the terms of Yamazaki Claims 11 through 47 are supported by the present application.

(1) Yamazaki Claim 11

Yamazaki Claim 11 is an independent claim, which Applicants submit is supported as shown by the following

Table D:

TABLE D

Yamazaki Claim 11	support in present application
[11(a)] An optical apparatus comprising:	[11(a)] An optical device is disclosed. See, e.g., p. 1, lines 5-8; p. 2, line 27; p. 3, line 12; p. 6, line 7.
[11(b)] means for forming an image to be observed; and	[11(b)] The optical device includes a display means 4 composed of, for example, a liquid crystal display (LCD) device, for "displaying an original image such as a character or a pattern". See, e.g., Figs. 1A through 8B, 12A through 19B, and 23A and 23B; p. 6, lines 9 through 11; p. 15, lines 22 and 23; p. 23, lines 6 through 10; p. 49, lines 20 through 22.

[11(c)] an ocular optical system for leading said image to an observer's eyeball,

[11(c)] The optical device also includes an optical system 3 having a first optical member 3a "for guiding light from the display means 4 to the eye of the observer". See, e.g., Figs. 1A through 8B, 12A through 19B, and 23A and 23B; p. 6, lines 11-21; p. 8, line 26; p. 23, line 23 through p. 24, line 1; p. 51, lines 3 through 5 and 20 through 22.

<p>[11(d)] said ocular optical system including, in order from said image side,</p> <p>[11(d)] a third surface which forms an entrance surface,</p> <p>[11(d)] a first surface which forms both a reflecting surface and an exit surface, and</p> <p>[11(d)] a second surface which forms a reflecting surface,</p> <p>[11(d)] said first to third surfaces being integrally formed with a medium disposed therebetween,</p>	<p>[11(d)] The first ocular member 3a includes:</p> <p>[11(d)] a light entrance face 5 ("The light from the display means 4 at first enters the first optical member 3a..."),</p> <p>[11(d)] a totally reflecting face 1 ("then totally reflecting face 1...") -- see also (3) below</p> <p>[11(d)] a concave mirror 2 ("further reflected by a concave half mirror 2... transmitted by the above-mentioned totally reflecting face 1 and guided to the eye...") (p. 6, lines 11-21)</p> <p>[11(d)] and is made of, e.g., acrylic resin or glass (p. 17, lines 4-6)</p> <p>See, e.g., Figs. 1A through 8B, 12A through 19B, and 23A and 23B; p. 6, lines 11 through 21; p. 7, lines 13 through 19; p. 8, lines 2 through 4, 19, and 20; p. 9, lines 25 through 27; p. 11, lines 7 through 10; p. 17, lines 4 through 6; p. 23, lines 17 through 23; p. 25, lines 3 through 11; p. 27, line 14 through p. 28, line 11; p. 31, lines 13 through 15; p. 32, line 24; p. 34, lines 24 through 27; p. 49, line 27 through page 50, line 5; page 51, lines 13 through 22; Numerical Examples 1 through 9.</p>
<p>[11(e)] wherein said means for forming an image is an image display device for forming an image for observation,</p>	<p>[11(e)] See 11(b).</p>

<p>[11(f)] said device being disposed at a position facing said third surface,</p>	<p>[11(f)] "The light from the display means 4 at first enters the first optical member 3a" (i.e., through light entrance face 5). See, e.g., Figs. 1A through 8B, 12A through 19B, and 23A and 23B; p. 6, lines 14 through 21; p. 25, lines 3 through 7; p. 51, lines 13 through 17; Numerical Examples 1 through 9.</p>
<p>[11(g)] said optical apparatus further comprising means for fitting both said device and said ocular optical system to an observer's head,</p>	<p>[11(g)] The optical device can be "mounted on the head of the observer" as a "head-up display or spectacle-type display". See, e.g., Figs. 10, 11; p. 1, lines 6-8; p. 22, lines 1-2; p. 23, lines 1-4.</p>

[11(h)] wherein at least said first surface in said ocular optical system is formed from a rotationally asymmetric curved surface so as to correct aberrations produced by a decentered surface having an optical action.

[11(h)] The totally reflecting face 1 may employ a toric or anamorphic aspherical surface (e.g., p. 16, lines 17-26), and "correction is attained for the eccentric aberration" relating to concave mirror 2, which is eccentric (e.g., p. 9, lines 25-27; p. 28, lines 12-23). See, e.g., Figs. 1A through 8B, 12A through 19B, and 23A and 23B; p. 16, lines 17-26 ("The configuration shown in Figs. 2A and 2B employs toric aspherical surfaces in the concave mirror and the totally reflecting face. The configuration shown in Figs. 3A and 3B employs anamorphic aspherical surfaces in all of the concave mirror, totally reflecting face, and light entrance face. Also the configuration shown in Figs. 4A to 5B employ anamorphic aspherical surfaces in all the optical faces."), and "satisfactory correction is attained for the eccentric aberration generated when the angle between the incident light and the emerging light of the concave mirror 2 is made large...."); p. 7, lines 15-17 and 22-24; p. 10, lines 6-8; p. 23, lines 17-23 through p. 32, line 5; Numerical Examples 1 through 9.

(2) Yamazaki Claim 15

Yamazaki Claim 15 depends from Yamazaki Claim 11 and further recites: (1) a see-through optical system disposed in the vicinity of the second surface of the ocular optical system to transmit a bundle of light rays from an

outside world and lead it to the second surface of the ocular optical system, and (2) a shutter provided at a side of the see-through optical system which is closer to the outside world, the shutter allowing light to be selectively transmitted or shut off, which Applicants respectfully submit are supported respectively by, e.g., second optical member 3b and transmissive liquid crystal device (shield member) 11. See, e.g., Figs. 1A through 8B, 12A through 19B, and 23A and 23B; (1) second optical member 3b: p. 6, lines 11-14; p. 6, line 24 through p. 7, line 3 ("As the concave mirror is composed of a half mirror, the observer can observe the image on the display means 4, superimposed with the external scenery...."); p. 25, line 21 through p. 26, line 2; p. 28, line 24 through p. 29, line 2; p. 51, line 23 through p. 52, line 4; and (2) liquid crystal device 11: Figs. 19A and 19B; p. 58, lines 10-19; p. 62, lines 22-27; p. 64, lines 20-24.

(3) Yamazaki Claim 16

Yamazaki Claim 16 depends upon Yamazaki Claim 15 and further recites that:

(a) a surface of the see-through optical system on which outside world light is incident has a configuration approximated to the first surface of the ocular optical system; and

(b) a surface of the see-through optical system from which outside world light emanates has a configuration

approximated to the second surface of the ocular optical system.

With respect to feature (a), Applicants respectfully submit that support may be found, e.g., at Figs. 19A and 19B; p. 9, lines 20-24 ("since the totally reflecting face is concave to the eye, the light entrance face at the outside is constituted by a substantially same curved surface..."). As for feature (b), Applicants respectfully submit that support may be found, e.g., at p. 49, line 27 through p. 50, line 30 ("The face 2a of the first optical member 3A and the face 2b of the second optical member 3B are adhered....").

(4) Yamazaki Claim 17

Yamazaki Claim 17 is an independent claim, which Applicants submit is supported, e.g., as shown by the following Table E:

TABLE E

Yamazaki Claim 17	support in present application
[17(a)] An optical apparatus comprising:	[17(a)] see 11(a)
[17(b)] a device for displaying an image; and	[17(b)] see 11(b)
[17(c)] an ocular optical system for projecting an image formed by said device and for leading the image to an observer's eyeball,	[17(c)] see 11(c)

[17(d)] said ocular optical system comprising at least first, second and third surfaces, in which a space defined by said surfaces is filled with a medium,	[17(d)] see 11(d)
[17(e)] said device being disposed at a position facing said third surface,	[17(e)] see 11(f)
[17(f)] said at least first, second and third surfaces including, in order from the observer's eyeball side toward said device, said first surface which serves as both a refracting surface and an internally reflecting surface, said second surface which serves as a reflecting surface of positive power and which faces said first surface and is decentered or tilted with respect to an observer's visual axis, and said third surface which serves as a refracting surface closest to said device,	[29(f)] See 11(d)
[17(g)] wherein at least said first surface in said ocular optical system is formed from a rotationally asymmetric curved surface so as to correct aberrations produced by a decentered surface having an optical action.	[17(g)] See 11(h)

(5) Yamazaki Claim 20

Yamazaki Claim 20 depends from Yamazaki Claim 17 and further recites that the internal reflection from the first surface is total reflection, which Applicants submit is supported by, e.g., totally reflecting face 1. See, e.g., p. 6, lines 16 and 17; p. 7, lines 13 through 15; p. 10, line 2; p. 23, lines 17 through 19; p. 25, lines 7 through 11; p. 51, line 17; Numerical Examples 1 through 9; Figs. 1A through 8B, 12A through 19B, and 23A and 23B.

(6) Yamazaki Claim 23

Yamazaki Claim 23 is an independent claim and is supported as shown by the following Table F:

TABLE F

Yamazaki Claim 23	support in present application
[23(a)] An optical apparatus comprising:	[23(a)] see 11(a)
[23(b)] an image display device; and	[23(b)] see 11(b)
[23(c)] an ocular optical system for projecting an image formed by said image display device and for leading the image to an observer's eyeball,	[23(c)] see 11(c)
[23(d)] said ocular optical system including a decentered optical element comprising at least first, second, and third surfaces, in which a space defined by said surfaces is filled with a medium, said surfaces including, from said observer's eyeball side toward said image display device, said first surface serving as both a refracting surface and a totally reflecting surface, said second surface serving as a reflecting surface of positive power which faces said first surface and is decentered or tilted with respect to an observer's visual axis, and said third surface serving as a refracting surface closest to said image display device,	[23(d)] see 11(d); see also 11(f)

[23(e)] said image display device being disposed at a position facing said third surface,	[23(e)] see 11(f)
[23(f)] said ocular optical system further including at least one optical surface having refracting action, said decentered optical element and said at least one optical surface being disposed in an optical path which extends from said image display device to said observer's eyeball,	[23(f)] There may also be provided an optical member 10, e.g., comprising a "transparent parallel-faced flat plate and incorporating therein a dichroic mirror 7 serving as a beam splitter for transmitting the visible light and reflecting the infrared light." See, e.g., p. 23, lines 10-16; p. 25, lines 3-7; p. 49, lines 22-26 (flat prism 10); p. 51, lines 13-19; Figs. 8, 13, 14, 18, 19, and 23.
[23(g)] wherein at least said first surface in said ocular optical system is formed from a rotationally asymmetric curved surface so as to correct aberrations produced by a decentered surface having an optical action.	[23(g)] see 11(h)

(7) Yamazaki Claim 28

Yamazaki Claim 28 depends from Yamazaki Claim 23 and further recites that the at least one optical surface is disposed between the observer's eyeball and the first surface of the decentered optical element. Applicants respectfully submit that support may be found at, e.g., Fig. 13; p. 35, lines 19-22 ("the optical member 10 is provided between the eye 103 of the observer and the prism member 3").

(8) Yamazaki Claim 29

Yamazaki Claim 29 depends from Yamazaki Claim 23 and further recites that the at least one optical surface is disposed between the third surface of the decentered optical element and the image display device. Applicants respectfully submit that support may be found at, e.g., Figs. 8A, 8B, 18A, 19A, 19B, 23A, and 23B; p. 25, lines 3-7 ("a visible light beam based on the image information displayed on the display means 4 is transmitted by the dichroic mirror face 7 of the optical member 10 and is introduced into the prism member 3 through the entrance surface 5...."); p. 51, lines 13-19.

(9) Yamazaki Claim 30

Yamazaki Claim 30 depends from Yamazaki Claim 23 and further recites that the at least one optical surface is decentered with respect to the observer's visual axis, which Applicants submit is supported by, e.g., Figs. 8A, 8B, 13, 14, 18A, 19A, 19B, 23A, and 23B.

(10) Yamazaki Claims 12-14, 18, 19, and 24-27

Yamazaki Claims 12 through 14, 18, 19, and 24 through 27 have been formulated upon the basis of Yamazaki Claims 11, 15, 16, 17, 20, 23, and 28 through 30, respectively, and further recite providing the combination of the image display device and the ocular optical system for each of observer's left and right eyeballs so as to lead an

image to each of the observer's left and right eyeballs, which Applicants respectfully submit is supported by, e.g., p. 1, lines 6 through 8; p. 22, lines 1 and 2; p. 23, lines 1 through 4; Figs. 10 and 11 (the display device can be "mounted on the head of the observer" as a so-called "head-up or spectacle-type display").

(11) Yamazaki Claims 21 and 22

Yamazaki Claim 21 depends from Yamazaki Claims 17 through 20, and Yamazaki Claim 22 depends therefrom, and respectively further recite (a) that any one of the first, second and third surfaces is a decentered aspherical surface, and (b) that any one of the first, second and third surfaces is an anamorphic surface. For support, Applicants respectfully refer to, e.g., the discussion of Yamazaki Claim 11, feature (h), in Table D above.

(12) Yamazaki Claim 31

Yamazaki Claim 31 depends from Yamazaki Claims 23 through 30 and further recites that the at least one optical surface and the decentered optical element form an air lens, which Applicants submit is supported by, e.g., Figs. 8A, 8B, 13, 19A, 19B, 23A, and 23B.

(13) Yamazaki Claims 32 through 35

Yamazaki Claims 32 through 35 variously depend from Yamazaki Claims 17 through 20 and 23 through 30, and further recite:

(a) means for positioning both the device and the ocular optical system with respect to an observer's head (Yamazaki Claim 32), or means for supporting both the device and the ocular optical system with respect to an observer's head so that the optical apparatus can be fitted to the observer's head (Yamazaki Claim 33); or

(b) means for supporting a pair of the optical apparatuses (Yamazaki Claim 34), or the combinations (Yamazaki Claim 35), at a predetermined distance.

For support, Applicants refer, e.g., to the discussion of Yamazaki Claims 12 through 14, 18, 19, and 24 through 27, in Section (10) above.

(14) Yamazaki Claim 36

Yamazaki Claim 36 depends from Yamazaki Claims 17 through 20 and 23 through 30 and further recites that the ocular optical system is used as an imaging optical system, which Applicants submit is supported by, e.g., imaging lens 8, which images light that passes through the optical member 3. See, e.g., p. 24, lines 8 through 13; p. 52, lines 7 through 19; Numerical Examples 5 through 9; Figs. 8B, 9, 16, 19B, and 23B.

(15) Yamazaki Claims 37 through 47

Yamazaki Claims 37 through 47 variously depend upon Yamazaki Claims 11 through 36 and further recite that the medium is acrylic resin or glass, which Applicants submit is supported at, e.g., p. 17, line 5.

D. Benefit of earlier applications for priority

Applicants are entitled to the benefit of the following applications (1) through (4) for proposed Count 1 and (1), (2), and (4) for proposed Count 2, as discussed in more detail below:

- (1) U.S. Patent Application No. 08/959,285 filed October 24, 1997 (the "'285 Application");
- (2) U.S. Patent Application No. 08/478,688 filed June 7, 1995 (the "'688 Application");
- (3) Japanese Patent Application No. 6-204268 filed August 5, 1994 (the "'268 Application"); and
- (4) Japanese Patent Application No. 6-130301 filed June 13, 1994 (the "'301 Application").

The '285 and '688 Applications

In particular, the present application is a divisional application under 37 CFR 1.53(b) of the '285 Application, which is a continuation application under former 37 CFR 1.62 of the '688 Application, and the specification and drawings of these applications as filed are identical, and each of the '285 Application and the '688 Application

constitutes a constructive reduction to practice of the subject matter of proposed Counts 1 and 2, which have been formulated upon the basis of Yamazaki claims that are submitted by Applicants to be fully supported, as discussed above in detail.

The '301 and '268 Applications

Count 1

As shown by the following Tables G-K, the terms of proposed Count 1 are also submitted by Applicants to be supported by the '301 and '268 Applications, thus establishing that each such application constitutes a constructive reduction to practice of the subject matter of the proposed count (references in the Tables are to the pages and line numbers of the sworn English translations filed February 23, 2000). It will be appreciated that Alternatives A-D are supported in both the '301 and '268 Applications, and that Alternative E is supported in the '268 Application.

TABLE G

Count 1, Alternative A	support in '301 Application	support in '268 Application
[1(A)(a)] An optical apparatus comprising:	[1(A)(a)] A display device is disclosed. See, e.g., p. 4, [0001], lines 4-5; p. 8, [0013], line 3; Figs. 1 through 5.	[1(A)(a)] See, e.g., p. 8, [0001], line 2.

[1(A)(b)] means for forming an image to be observed; and	[1(A)(b)] The display device includes a display means 4 composed of, for example, a liquid crystal display (LCD) device. See, e.g., p. 7, [0010], lines 4 through 7; Figs. 1 through 5.	[1(A)(b)] See, e.g., p. 18, [0019], lines 2 through 4; Figs. 1 and 6 through 12.
[1(A)(c)] an ocular optical system for leading said image to an observer's eyeball,	[1(A)(c)] The display device also includes an optical system 3 having a first optical member 3a that guides the light from the display means 4 to the eye of the observer. See, e.g., p. 10, [0017], line 3; Figs. 1 through 5.	[1(A)(c)] See, e.g., p. 18, [0020]; Figs. 1 through 3 and 6 through 12.
[1(A)(d)] said ocular optical system including, in order from said image side, [(1)] a third surface which forms an entrance surface, [(2)] a first surface which forms both a reflecting surface and an exit surface, and [(3)] a second surface which forms a reflecting surface, [(4)] said first to third surfaces being integrally formed with a medium disposed therebetween,	[1(A)(d)] The first optical member 3a includes a [(1)] totally reflecting face 1, [(2)] a concave mirror 2, and [(3)] a light entrance face 5, and [(4)] is made of, e.g., acrylic resin or glass. See, e.g., p. 7, [0010], lines 12 through 15; p. 13, [0025], line 1; p. 19, [0037], lines 1 through 3; Numerical Examples 1 through 4; Figs. 1 through 5.	[1(A)(d)] See, e.g., p. 18, [0020], lines 1 through 7; p. 18, [0020], line 7; p. 20, [0022], lines 10 through 13; Numerical Examples 1 through 5; Figs. 1 through 3 and 6 through 12.
[1(A)(e)] wherein said means for forming an image is an image display device for forming an image for observation,	[1(A)(e)] see 1(A)(b)	[1(A)(e)] see 1(A)(b)

[1(A)(f)] said device being disposed at a position facing said third surface,	[1(A)(f)] The light from the display means enters the first optical member 3a through light entrance face 5. See, e.g., p. 7, [0010], lines 10-11; Figs. 1-5.	[1(A)(f)] See, e.g., [0020]; Figs. 1-3 and 6-12.
[1(A)(g)] said optical apparatus further comprising means for fitting both said device and said ocular optical system to an observer's head,	[1(A)(g)] A head-up display or spectacle-type display is provided. See p. 4, [0001].	[1(A)(g)] The device may be mounted on the head of the observer. See, e.g., [0018]; Figs. 4 and 5.
[1(A)(h)] wherein at least said first surface in said ocular optical system is formed from a rotationally asymmetric curved surface so as to correct aberrations produced by a decentered surface having an optical action.	[1(A)(h)] The totally reflecting face 1 may employ a surface having optical power depending upon the azimuthal angle, e.g., a toric or anamorphic aspherical surface, to "correct the aberrations generated by the concave mirror" which is eccentric. See, e.g., pp. 8-10, [0014]-[0016]; Numerical Examples 1-4; Figs. 1-5; p. 19, [0035] ("The configuration shown in Fig. 2 employs toric aspherical surfaces in the concave mirror and the total reflection surface. The configuration shown in Fig. 3 employs anamorphic aspherical surfaces in all of the concave mirror, total reflection surface and light entrance face. Also the configurations shown in Figs. 4 and 5 employ anamorphic aspherical surfaces in all the optical surfaces.")	[1(A)(h)] See, e.g., p. 24, [0030]; Numerical Examples 1 through 5.

TABLE H

Count 1, Alternative B	support in '301 Application	support in '268 Application
[1(B)(a)] An optical apparatus comprising:	see 1(A)(a)	see 1(A)(a)
[1(B)(b)] a device for displaying an image; and	see 1(A)(b)	see 1(A)(b)
[1(B)(c)] an ocular optical system for projecting an image formed by said device and for leading the image to an observer's eyeball,	see 1(A)(c)	see 1(A)(c)
[1(B)(d)] said ocular optical system comprising at least first, second and third surfaces, in which a space defined by said surfaces is filled with a medium,	see 1(A)(d)	see 1(A)(d)
[1(B)(e)] said device being disposed at a position facing said third surface,	see 1(A)(f)	see 1(A)(f)
[1(B)(f)] said at least first, second and third surfaces including, in order from the observer's eyeball side toward said device, said first surface which serves as both a refracting surface and an internally reflecting surface, said second surface which serves as a reflecting surface of positive power and which faces said first surface and is decentered or tilted with respect to an observer's visual axis, and said third surface which serves as a refracting surface closest to said device,	see 1(A)(d)	see 1(A)(d)
[1(B)(g)] wherein at least said first surface in said ocular optical system is formed from a rotationally asymmetric curved surface so as to correct aberrations produced by a decentered surface having an optical action.	see 1(A)(h)	see 1(A)(h)

TABLE I

Count 1, Alternative C	support in '301 Application	support in '268 Application
[1(C)(a)] An optical apparatus comprising:	see 1(A)(a)	see 1(A)(a)
[1(C)(b)] a device for displaying an image; and	see 1(A)(b)	see 1(A)(b)
[1(C)(c)] an ocular optical system for projecting an image formed by said device and for leading the image to an observer's eyeball,	see 1(A)(c)	see 1(A)(c)
[1(C)(d)] said ocular optical system comprising at least first, second and third surfaces, in which a space defined by said surfaces is filled with a medium,	see 1(A)(d)	see 1(A)(d)
[1(C)(e)] said device being disposed at a position facing said third surface,	see 1(A)(f)	see 1(A)(f)
[1(C)(f)] said at least first, second and third surfaces including, in order from the observer's eyeball side toward said device, said first surface which serves as both a refracting surface and an internally reflecting surface, said second surface which serves as a reflecting surface of positive power and which faces said first surface and is decentered or tilted with respect to an observer's visual axis, and said third surface which serves as a refracting surface closest to said device,	see 1(A)(d)	see 1(A)(d)
[1(C)(g)] wherein at least said first surface in said ocular optical system is formed from a rotationally asymmetric curved surface so as to correct aberrations produced by a decentered surface having an optical action,	see 1(A)(h)	see 1(A)(h)

[1(C)(h)] wherein any one of said first, second and third surfaces is a decentered aspherical surface.	see 1(A)(h)	see 1(A)(h)
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TABLE J

Count 1, Alternative D	support in '301 Application	support in '268 Application
[1(D)(a)] An optical apparatus comprising:	see 1(A)(a)	see 1(A)(a)
[1(D)(b)] a device for displaying an image; and	see 1(A)(b)	see 1(A)(b)
[1(D)(c)] an ocular optical system for projecting an image formed by said device and for leading the image to an observer's eyeball,	see 1(A)(c)	see 1(A)(c)
[1(D)(d)] said ocular optical system comprising at least first, second and third surfaces, in which a space defined by said surfaces is filled with a medium,	see 1(A)(d)	see 1(A)(d)
[1(D)(e)] said device being disposed at a position facing said third surface,	see 1(A)(f)	see 1(A)(f)
[1(D)(f)] said at least first, second and third surfaces including, in order from the observer's eyeball side toward said device, said first surface which serves as both a refracting surface and an internally reflecting surface, said second surface which serves as a reflecting surface of positive power and which faces said first surface and is decentered or tilted with respect to an observer's visual axis, and said third surface which serves as a refracting surface closest to said device,	see 1(A)(d)	see 1(A)(d)

[1(D)(g)] wherein at least said first surface in said ocular optical system is formed from a rotationally asymmetric curved surface so as to correct aberrations produced by a decentered surface having an optical action,	see 1(A)(h)	see 1(A)(h)
[1(D)(h)] wherein any one of said first, second and third surfaces is a decentered aspherical surface, and	see 1(A)(h)	see 1(A)(h)
[1(D)(i)] wherein any one of said first, second and third surfaces is an anamorphic surface.	see 1(A)(h)	see 1(A)(h)

TABLE K

Count 1, Alternative E	support in '268 Application
[1(E)(a)] An optical apparatus comprising:	see 1(A)(a)
[1(E)(b)] an image display device; and	see 1(A)(b)
[1(E)(c)] an ocular optical system for projecting an image formed by said image display device and for leading the image to an observer's eyeball,	see 1(A)(c)

<p>[1(E)(d)] said ocular optical system including a decentered optical element comprising at least first, second, and third surfaces, in which a space defined by said surfaces is filled with a medium, said surfaces including, from said observer's eyeball side toward said image display device, said first surface serving as both a refracting surface and a totally reflecting surface, said second surface serving as a reflecting surface of positive power which faces said first surface and is decentered or tilted with respect to an observer's visual axis, and said third surface serving as a refracting surface closest to said image display device,</p>	<p>see 1(A)(c) and 1(A)(h)</p>
<p>[1(E)(e)] said image display device being disposed at a position facing said third surface,</p>	<p>see 1(A)(f)</p>
<p>[1(E)(f)] said ocular optical system further including at least one optical surface having refracting action, said decentered optical element and said at least one optical surface being disposed in an optical path which extends from said image display device to said observer's eyeball,</p>	<p>The system includes an optical member 10. See, e.g., p. 20, [0022], lines 7-9; p. 22, [0025]; pp. 32-33, [0048]; Numerical Embodiments 1 and 2; Figs. 1, 2, and 7.</p>
<p>[1(E)(g)] wherein at least said first surface in said ocular optical system is formed from a rotationally asymmetric curved surface so as to correct aberrations produced by a decentered surface having an optical action.</p>	<p>see 1(A)(h)</p>

Count 2

Count 2 is formulated upon the basis of Count 1(A) but further recites a see-through optical system disposed in

the vicinity of the second surface of the ocular optical system to transmit a bundle of light rays from an outside world and lead it to the second surface of the ocular optical system, wherein (1) a surface of the see-through optical system on which outside world light is incident has a configuration approximated to the first surface of the ocular optical system, and (2) a surface of the see-through optical system from which outside world light emanates has a configuration approximated to the second surface of the ocular optical system. Applicants respectfully submit that support may be found in the '301 Application at, e.g., Fig. 1(B) (second optical element 3b); p. 11, [0019] ("since the total reflection surface is concave to the eye, the light entrance face at the outside is constituted by a substantially same curved surface in order to prevent the distortion in the observed scenery."), and in that the first and second optical members meet at surface 2 (e.g., Fig. 1(B)); see also Figs. 2-5. For these reasons, and those set forth above with respect to Count 1(A), Applicants submit that the '301 Application constitutes a constructive reduction to practice of Count 2.

E. Summary of proposed interference

The following Tables L and M summarize Applicants' proposal for the interference, with Counts 1 and 2 as proposed above:

TABLE L

Applicants (Senior Party):	Shoichi Yamazaki and Takeshi Nishimura
Application No.:	U.S. Patent Application No. 09/511,243 filed February 23, 2000
For:	HEAD-UP DISPLAY DEVICE WITH CURVED OPTICAL SURFACE HAVING TOTAL REFLECTION (AS AMENDED)
Assignee:	Canon Kabushiki Kaisha
Accorded Benefit:	<p><u>for Count 1</u></p> <p>(1) U.S. Patent Application No. 08/959,285 filed October 24, 1997; (2) U.S. Patent Application No. 08/478,688 filed June 7, 1995; (3) Japanese Patent Application No. 6-204268 filed August 5, 1994; and (4) Japanese Patent Application No. 6-130301 filed June 13, 1994.</p> <p><u>for Count 2</u></p> <p>(1) U.S. Patent Application No. 08/959,285 filed October 24, 1997; (2) U.S. Patent Application No. 08/478,688 filed June 7, 1995; and (3) Japanese Patent Application No. 6-130301 filed June 13, 1994.</p>
Claims corresponding to Count 1:	11-13, 15, 17-20, 21/(17-20), 22/21/(17-20), 23-30, 31/(23-30), 32/(17-20), 32/(23-30), 33/(17-20), 33/(23-30), 34/17, 34/20, 34/(23 and 28-30), 35/18, 35/19, 35/(24-27), 36/(17-20), 36/(23-30), 37/(11-13 and 15), 38/(17-20), 39/21/(17-20), 40/22/21/(17-20), 41/(23-30), 42/31/(23-30), 43/32/(17-20), 43/32/(23-30), 44/33/(17-20), 44/33/(23-30), 45/34/17, 45/34/20, 45/34/(23 and 28-30), 46/35/18, 46/35/19, 46/35/(24-27), 47/36/(17-20), and 47/36/(23-30)
Claims corresponding to Count 2:	14, 16, 37/14, and 37/16

TABLE M

Patentee (Junior Party)	Koichi Takahashi
Application No.:	U.S. Patent Application No. 08/912,119 filed August 15, 1997, Patent No. 5,875,056 granted February 23, 1999
For:	HEAD OR FACE MOUNTED IMAGE DISPLAY APPARATUS
Assignee:	Olympus Optical Co., Ltd.
Claims corresponding to Count 1:	1, 3, 5-7, 8/(5-7), 9/8/(5-7), 10-12, 14, 15, 17/(10-12, 14, and 15), 18/(5- 7), 18/(10-12, 14, and 15), 19/(5-7), 19/(10-12, 14, and 15), 20/(5-7), 20/(10-12, 14, and 15), 21/(5-7), 21/(10-12, 14, and 15), 22/1, 22/5, 22/10, 23/1, 23/5, 23/10, 24/23/1, 24/23/5, and 24/23/10
Claims corresponding to Count 2:	Claim 4

CONCLUSION

Since the requirements of 37 CFR 1.607 have been satisfied, Applicants request that an interference, with Counts 1 and 2 as proposed above, be declared between the present application and the Takahashi '056 patent. Applicants also respectfully request senior party status by virtue of the earlier filing date. In addition, Applicants respectfully request benefit for priority of the filing dates of the '285, '688, '301, and '268 Applications for proposed Count 1 and benefit for priority of the filing dates of the '285, '688, and '301 Applications for proposed Count 2.

Applicants' undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our below-listed address.

Respectfully submitted,

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